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HIGH SCHOOL ELECTRICITY AND OTHER SELECTED FACTORS AS PREDICTORS OF SUCCESS IN THE N.A.I.T. TWO YEAR ELECTRONICS PROGRAM

by

© YUET TANG LEE

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled, "High School Electricity and Other Factors as Predictors of Success in the N.A.I.T. Two Year Electronics Program," submitted by Yuet Tang Lee in partial fulfillment of the requirements for the degree of Master of Education.

ABSTRACT

This study was undertaken to investigate the prediction of academic success of students in the two year Electronic Technology program at the Northern Alberta Institute of Technology.

The sample consisted of those students (146) who had completed the two year Electronic Technology Program at the Northern Alberta Institute of Technology during the period May, 1972 to May, 1973 and for whom D.A.T. Subtest (VR + NA) and high school marks were available.

Statistical analysis of this study included the analysis of covariance technique with scholastic aptitude as the covariate. Achievement represented by the final marks in the NAIT Electronic Technology Program was considered for each of four groups: (A) Students without high school electricity (N=94); (B) Students with thirty-five credits of high school electricity (N=21); (C) Students with five to twenty credits of high school electricity (N=31); (D) Students with ten to twenty credits of high school electricity (N=20).

The stepwise multiple regression technique was used to determine the best predictors of first and second year Electronics final marks based on the following D.A.T. Subtest and high school subjects: Electricity 12 (or Electronics 10), Electricity (or Electronics) 22, Electricity (or Electronics) 32, English 30, Mathematics Average, Science Average and Departmental Average were used as predictors.

Three different analyses were made with different sets of predictors.

The results of the analysis of covariance indicated that students

with two or more courses of electricity instruction in high school achieved significantly higher marks in the first year electronics final than students who had not received such instruction. However upon completion of the program at the end of the second year, no difference in Electronics achievement was found between students who had prior instruction in electricity and those who had no instruction in electricity prior to entering the N.A.I.T. Electronics Program. When all predictors except Electricity 12 or Electronics 10 were included as predictors for the stepwise multiple regression analysis (N=19), D.A.T. Subtest and Departmental Average were selected as the two best predictors. For these students 60.90 percent of variance was accounted for when predicting achievement at the end of the first year of the program and 60.57 percent, at the end of the second year. With all predictors except Electricity (or Electronics) 22 and 32 (N=21), Mathematics Average was selected as the best predictor. For these students 52.99 percent of variance was accounted for when predicting achievement at the end of the first year of the program and 38.69 percent at the end of the second year. With all predictors except high school electricity instruction (N=82), Departmental Average was selected as the best predictor. For these students 30.25 percent of variance was accounted for when predicting achievement at the end of the first year of the program and 30.83 percent at the end of the second year.

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INTRODUCTION

Concern with the prediction of academic success of students in post-secondary programs of study has increased during recent years (MacDonald, 1970, p. 6). The value of such prediction, even if present knowledge cannot guarantee that correct determinations can be made with a high degree of consistency, clearly lies in the additional help it may give a student in deciding which program of study to pursue. No doubt, in making such decisions, the student has traditionally been guided by advice from parents, friends and counsellors, as well as by printed information. Still, it cannot be denied that the greater the degree of relevant information possessed by the student, the greater the potential for good decision-making. Bloom (1961, pp. v-vi) has illustrated the argument rather well as follows:

> If he chooses a course, a college, and a curriculum that fulfill his needs and challenge but do not overtax his capabilities he is liable to gain much from higher education. If he chooses a college and program with requirements far above his possibility of attainment, he will suffer the frustration and loss of time and opportunity consequent on failure. . . .The matter of choice is not just the student's concern. . .colleges that accept students who fail suffer great losses in utilization of faculty and other resources.

STATEMENT OF THE PROBLEM

According to the information from Mr. S. M. Checkley (1974) Head of Student Counselling Center, the Northern Alberta Institute of Technology (N.A.I.T.) does not have adequate means of predicting success or failure in the Two-year Electronic Technology Program.

The purpose of this study is to answer the following general questions:

1. Do students who have received one or more courses of electricity instruction in high school achieve higher weighted average scores at the end of the first and second year of the N.A.I.T. Two year Electronic Technology program than students who have not received any high school electricity instruction?

2. From among a number of high school diploma subjects, which are the best predictors of higher weighted average scores at the end of the first and second year of the N.A.I.T. Two year Electronic Technology program? From these findings it is proposed to develop equations for predicting success of applicants to the N.A.I.T. Two year Electronics Technology Program.

SIGNIFICANCE OF THE STUDY

This study will provide estimates of N.A.I.T. first and second year final scores in the Two year Electronic Technology program with selected secondary school subjects as predictors. It has been shown that grades in secondary school are effective predictors of success in the freshman year of college. However very little work has been done to date regarding the predictive validity of high school grades for technology programs. Almost all studies predict academic performance at only one point in time. For example, most research on college performance is concerned with the prediction of grades in the freshman year. This report attempts to rectify this omission and provide information regarding the consistency of performance and the degree to which it is predictable over a period of more than one year, an area which Lavin

(1965, p. 58) points up as one requiring further study.

HYPOTHESES

The hypotheses are divided into two sections: Part I includes those hypotheses relating to the achievement of Electronic Technology students with or without prior electricity instruction. Part II includes those hypotheses pertaining to the selection of predictors of success of Electronic Technology students.

Part I

The design of Part I of the study is shown in Figure 1 p. 5. In order to increase the precision of the study a statistical treatment is applied to the Electronics final marks to adjust the initial differences in the data. This is known as the adjusted Electronics final marks.

The rationale for the hypotheses stated on page 6 is to find out whether students who took high school electricity courses achieved higher scores in N.A.I.T. Electronics final marks than students who had no high school electricity instruction.

In order to achieve such a goal, a test to measure the differences between means of the adjusted Electronics final marks of students in Groups A, B, C and D was required. Six differences were required in accordance with the six hypotheses in Part I.

The division of meaningful subgroups is given as follows:

Group A - includes all the students who have completed no high school electricity courses.

Group B - includes all the students who have completed thirty-five credits of high school electricity courses. This

represents all those who have completed the Electricity or Electronics Vocational Program in high school.

Group C - includes all the students who have completed five to twenty credits of high school electricity courses. this represents all those who have taken one or more high school Industrial Arts or Vocational electricity courses but did not complete the entire Vocational program.

Group D - includes all the students who have taken ten to twenty credits of high school electricity courses. This includes those who have more than one high school Industrial Arts or Vocational electricity courses but did not complete the whole Vocational program.

First Year

Hypothesis 1a

A

— significant difference Yes / No ?

B

Hypothesis 2a

A

— significant difference Yes / No ?

C

Hypothesis 3a

A

— significant difference Yes / No ?

D

Second Year

Hypothesis 1b

A

— significant difference Yes / No ?

B

Hypothesis 2b

A

— significant difference Yes / No ?

C

Hypothesis 3b

A

— significant difference Yes / No ?

D

Question to be Answered: Are there any significant differences in the adjusted first and second year Electronics final marks between the following groups:

Group A: Students had no electricity in high school

Group B: Students with 35 credits high school electricity

Group C: Students with 5-20 credits high school electricity

Group D: Students with 10-20 credits high school electricity

FIGURE 1

Design of Study Part I

Comparison of Electronics Final Marks Between Groups

Statement of Hypotheses, Part I

1. (a) There is no significant difference at the 0.05 level in the adjusted first year Electronics final marks between students who have had thirty-five credits of electricity instruction in high school and students who have had no electricity instruction in high school.

   (b) There is no significant difference at the 0.05 level in the adjusted second year Electronics final marks between students who have had thirty-five credits of electricity instruction in high school and students who have had no electricity instruction in high school.

2. (a) There is no significant difference at the 0.05 level in the adjusted first year Electronics final marks between students who have had five to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

   (b) There is no significant difference at the 0.05 level in the adjusted second year Electronics final marks between students who have had five to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

3. (a) There is no significant difference at the 0.05 level in the adjusted first year Electronics final marks between students who have had ten to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

   (b) There is no significant difference at the 0.05 level in the

adjusted second year Electronics final marks between students who have had ten to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

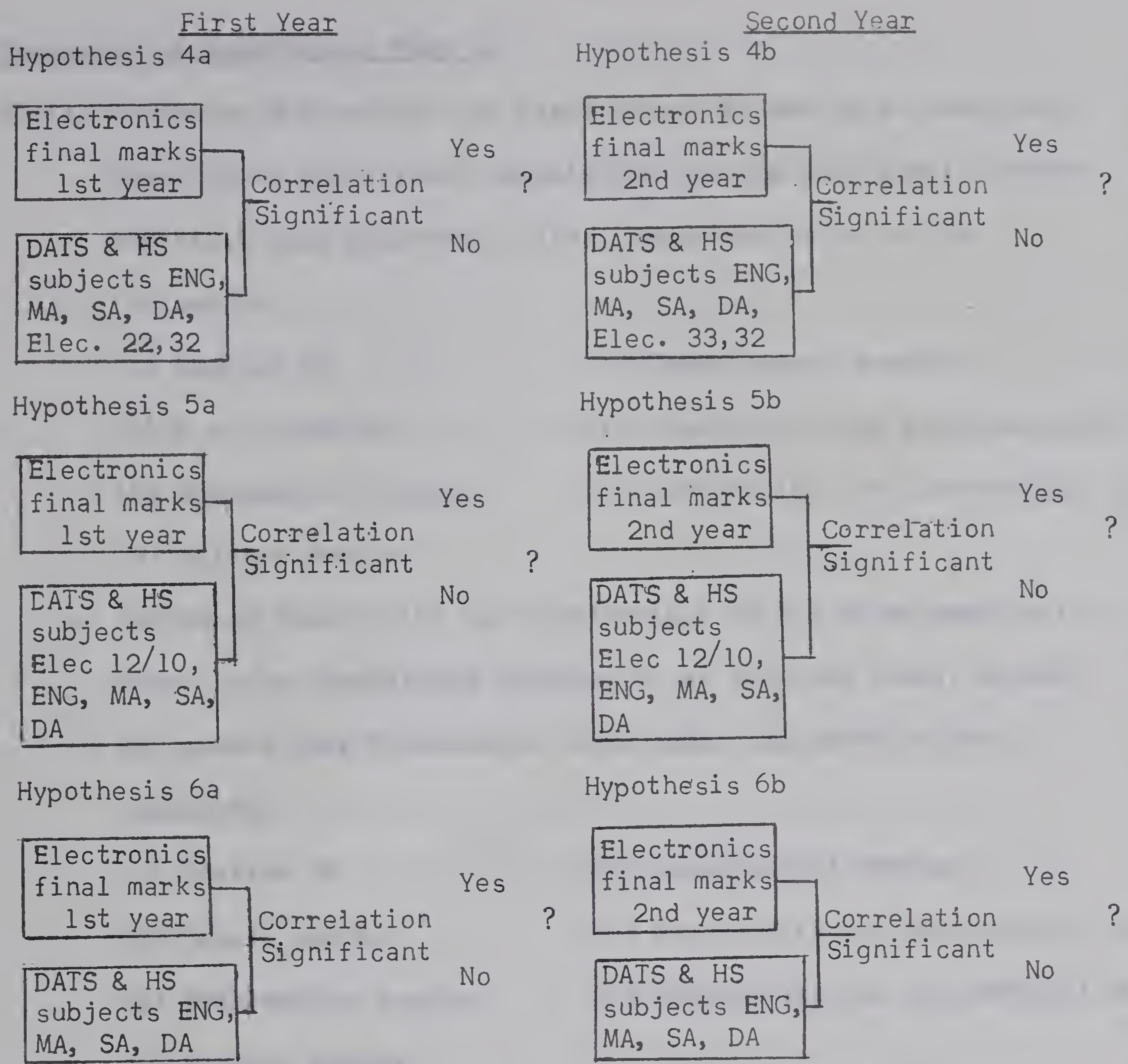
Part II

The design of Part II of the study is shown in Figure 2, p. 8. The rationale for the hypotheses stated on page 9 is to discover the best predictors among high school subject marks and D.A.T. Subtest scores. Hence, the respective prediction equations can be derived.

In order to obtain the prediction equations, a test to measure both the correlation between Electronics final marks and high school subject marks as well as the correlation between Electronics final marks and D.A.T. Subtest scores was required. Hence the six hypotheses in Part II of the study were tested to provide the basis for the development of the respective prediction equations.

The division of meaningful subgroups is given as follows:

1. The group in Hypotheses 4(a) and (b) contains students who have taken Electricity or Electronics 22, 32, D.A.T. Subtest and other high school subjects.
2. The group in Hypotheses 5(a) and (b) contains students who have taken Electricity 12 or Electronics 10, D.A.T. Subtest and other high school subjects.
3. The group in Hypotheses 6(a) and (b) contains students who have taken D.A.T. Subtest and ordinary high school subjects without electricity courses.



Question to be Answered: Are there any significant correlations between first and second year Electronics final marks (criteria) and DATS Subtest, high school marks (predictors): English 30 (ENG); Mathematics Average (MA); Science Average (SA); Departmental Average (DA); Electricity 12/Electronics 10 (Elec 12/10); Electricity/Electronics 22 (Elec 22); Electricity/Electronics 32 (Elec 32).

FIGURE 2

Design of Study Part II

Correlations, Electronics Final Marks and DAT Subtest, High School Subjects

Statement of Hypotheses, Part II

4. (a) Including Electricity (or Electronics) 22 and 32 as predictors, there is no significant correlation, at the 0.05 level, between the first year Electronics final marks and marks in the following:

(1) English 30
(2) D.A.T. Subtest
(3) Mathematics Average
(4) Science Average
(5) Departmental Average
(6) Electricity (or Electronics 22)
(7) Electricity (or Electronics) 32

(b) Including Electricity (or Electronics) 22 and 32 as predictors, there is no significant correlatin, at the 0.05 level, between the second year Electronics final marks and marks in the following:

(1) English 30
(2) D.A.T. Subtest
(3) Mathematics Average
(4) Science Average
(5) Departmental Average
(6) Electricity (or Electronics) 22
(7) Electricity (or Electronics) 32

5. (a) Including Electricity 12 (or Electronics 10) as a predictor, there is no significant correlation, at the 0.05 level, between first year Electronics final marks and marks in the following:

(1) Electricity 12 (or Electronics 10)
(2) English 30
(3) D.A.T. Subtest
(4) Mathematics Average
(5) Science Average
(6) Departmental Average

(b) Including Electricity 12 (or Electronics 10) as a predictor, there is no significant correlation, at the 0.05 level, between second year Electronics final marks and marks in the following:

(1) Electricity 12 (or Electronics 10)
(2) English 30
(3) D.A.T. Subtest
(4) Mathematics Average
(5) Science Average
(6) Departmental Average

6. (a) Excluding students who have had high school electricity courses as predictors, there is no significant correlation, at the 0.05 level, between first year Electronics final marks and marks in the following:

(1) English 30
(2) D.A.T. Subtest
(3) Mathematics Average
(4) Science Average
(5) Departmental Average

(b) Excluding students who have high school electricity courses as predictors, there is no significant correlation, at the 0.05 level, between second year Electronics final marks and marks in the following:

(1) English 30
(2) D.A.T. Subtest
(3) Mathematics Average
(4) Science Average
(5) Departmental Average

SCOPE OF THE STUDY

The present study was concerned with the two year Electronic Technology Program offered at the Northern Alberta Institute of Technology during the period September 1970 to May 1973. The investigation is delimited in its statistical treatment to students who had completed the two year program and had written the required examinations at the end of each of the six quarters (terms).

LIMITATIONS OF THE STUDY

1. No attempt is made in this study to determine the reasons for the contribution or non-contribution of high school electricity to achievement in Electronic Technology program.
2. Although other factors such as age and sex may affect achievement in the Electronic Technology program, these factors are not considered in the present study.
3. Forty-nine of the students who entered the program in 1970 and 1971 are not included in the sample because of lack of complete predictor data for them.
4. The reliability of grade 10, 11, and 12 marks, and marks in courses of the Electronics program, are not known.
5. The effect of different instructors or course changes is not considered.

DEFINITION OF TERMS

High School Electricity: This refers to the electricity courses available in Alberta high schools. Prior to September 1, 1970 these courses were:

(a) Industrial Arts Electronics 10, 20 (4 or 5 credits) and 30 (5 credits).

(b) Vocational Electricity 12 (5 or 10 credits), Electricity 22 (10 or 15 credits), and Electricity 32 (15 or 20 credits).

(c) Vocational Electronics 22 (10 or 15 credits), and Electronics 32 (15 or 20 credits).

High School Credit: The Department of Education, Alberta (1973-74, p. 15) defines a high school credit as follows:

> One credit represents 40 minutes minimum instruction time per week or 80 minutes per week in semestered schools exclusive in each case of time for class movement. A subject carrying a credit

value of five must receive at least 200 minutes instruction time per week or 400 minutes in semestered schools, that is, a five credit subject for a normal ten-month school year represents 200 minutes of instruction time per week or the equivalent of this time in schools operating on alternative organizational plans.

First and second year Electronics final marks: The first year Electronics final marks are obtained by averaging the weighted scores received for respective students in the first, second and third quarters in all courses taken during these three quarters. The second year Electronics final marks are obtained by averaging the weighted scores received for respective students in the fourth, fifth and sixth quarters in all courses taken during these three quarters. The Electronics final marks predicted in each case a weighted average of achievement in the whole of the student program.

First year students take just over one half of their courses in electronics, the remainder being sciences and general education. Second year students take three quarters of their courses in electronics, the remainder being sciences and general education.

Adjusted first and second year Electronics final marks: These marks would be either the first or the second year Electronic Technology program final marks after the statistical correction had been applied to partial out the differences in intelligence.

English 30, Social Studies 30, Mathematics 30, Chemistry 30, Physics 30, French 30, Biology 30 and Mathematics 31: These are matriculation subjects offered to grade twelve students in Alberta high schools. The Department of Education provides uniform province-wide examinations for these courses.

Mathematics Average: This refers to the average of a student's final marks in Mathematics 30, Mathematics 31 and Mathematics 33.

<u>Science Average</u>: This refers to the average of a student's final marks in Chemistry 30 and Physics 30.

<u>Departmental Average</u>: This term is used to designate the average of a student's final marks in English 30, Social Studies 30, Mathematics 30, Chemistry 30, Physics 30, French 30, Biology 30 and Mathematics 31.

<u>D.A.T. Subtest</u>: This is the Differential Aptitude Tests of the Psychological Corporation, New York, 1961 edition. The score used is the sum of the Verbal Reasoning (VR) mark and Numerical Ability (NA) mark achieved by the student on the test. The test is designed to measure scholastic aptitude.

CHAPTER II

REVIEW OF LITERATURE

This study is concerned with the prediction of success over the two year length of the Electronic Technology program.

In the review of literature, studies that attempted to predict problems of success in general are considered initially. These are followed by a review of the prediction of success in technical and vocational programs.

The sources of variation in academic performance suggested by Bloom and Peters (1961, pp. 5-6) are: errors in judgement of teachers about the quality of a student's achievement, the difference among students in achievement and motivation, and the difference in standards from school to school. They suggest that the errors in judgement of teachers have been grossly overestimated and that grade averages may have a high reliability if appropriate scaling procedures are applied to remove the error from the other sources of variation.

Bloom and Peters used the records of some 25,000 students who graduated from the 126 participating schools of the National Registration Office in the United States. The study was begun in 1956. Some of their relevant findings are as follows:

1. Average correlation between school and college grades is about +0.50 (Bloom and Peters, p. 37).

2. Median correlations between grade averages in adjacent college semesters is +0.79, median correlation between grade averages two semesters apart is +0.72, and median correlation between grade averages

three semesters apart is +0.66 (Bloom and Peters, p. 38).

3. Within a school or college, academic grades and aptitude scores correlate approximately +0.50 (Bloom and Peters, p. 59).

4. The vast majority of correlations used for predictory success from undergraduate college professional or graduate schools are between +0.30 and +0.60 (Bloom and Peters, p. 31).

5. When aptitude scores and high school grades are combined by a regression method and the scores are scaled to make them equivalent for different schools and colleges, the prediction of academic success can be improved to a correlation of about 0.75 (Bloom and Peters, p. 61).

Reliability of first year college grades is estimated to be in the order of +0.80, which represents the upper limit of prediction correlations unless the reliability of college grades is improved (Bloom and Peters, p. 131).

Assessment techniques, which take into account sociological and psychological factors, could be useful for prediction purposes. However, large scale applications have not yet been developed (Bloom and Peters, p. 30).

Lavin (1965) reviewed about 300 prediction studies published between 1953 and 1961. A summary of some of his conclusions related to this study is given below.

Measures of ability account for 35 to 45 percent of the variation in academic performance in high school and college (Lavin, p. 59).

A large proportion of the variance in academic achievement could be accounted for by nonintellective factors such as personality factors, sociological factors, and the interactions between them (Lavin, p. 166).

Bae (1967, pp. 1131-1136) hypothesized that a combination of

predictors which would maximize prediction of high school chemistry courses could be selected by means of multiple linear regression procedures, from among 15 selected subtests of the D.A.T., Iowa Chemistry Aptitude Examination (I.C.A.E.) and Science Aptitude Examination. She found that the combination of all fifteen predictors yielded a multiple correlation (R=0.78) which was not significantly better than that yielded by the best combination of four predictors as selected by a stepwise multiple linear regression procedure (R=0.75, N=117). This combination of four predictors included the I.C.A.E. information of Science Test, the D.A.T. Verbal Reasoning Subtest, the D.A.T. Numerical Ability Subtest, and the Science Aptitude Examination, Part B; Reading in Science. Her conclusion was that the most efficient predictors for high school chemistry grades fall into three categories: general intelligence, background experience in science and mathematics and reading comprehension, as measured by selected subtests of the D.A.T. Iowa Chemistry Aptitude Examination and Science Aptitude Examination.

Ferguson (1971, pp. 402-403) suggested that the greater part of the prediction equation can be achieved by a relatively small number of variables.

> Frequently, in practical work, the greater part of the prediction achieved can be attributed to a relatively small number of variables, perhaps four or five or six, and the inclusion of additional variables contributes only small and diminishing amounts to prediction. . . .
>
> Investigators concerned with problems of prediction frequently attempt to identify independent variables which show a high correlation with the criterion and a low correlation with each other. If two variables have a fairly high correlation with the criterion and a low correlation with each other, both measure different aspects of the criterion and both will contribute substantially to prediction. If two variables have a high correlation with each other, they are measures of much the same thing, and the inclusion of both, instead of either one or the other, will contribute little to the prediction achieved.

Geiss (1966) attempted to measure the relationship between high school background and success in the various technical programs offered at the Oregon Technical Institute. He reported the number of students who passed and who failed against whether or not they had taken a given high school course, or against the number of units of study they had completed in high school in a particular academic area. His sample consisted of all those students who entered the institute in 1960, 1961 and 1962. He did a separate analysis for students who entered with a high school grade point average of two or better and for those who entered with a high school grade point average of less than two.

Out of 116 electronics students with a G.P.A. of two or better in high school, 49 (42%) failed. Out of 26 electronics students with a high school grade point average of less than two, 19 (73%) failed (Geiss, p. 66). Algebra I, Geometry I and Trigonometry combined were highly predictive of success for both groups of Electronics students (Geiss, p. 100).

Generally, for engineering technologies he found that completion of physics, chemistry and mathematics courses in high school correlated most highly with success. There were substantial differences between the success ratios of those students who entered with a high school G.P.A. of two or better and those who entered with a high school G.P.A. of less than two. He also found that the number of industrial arts courses a student had in high school correlated negatively with success ratio in all technologies, and that nonacademic courses apparently do not prepare students for success at Oregon Technical Institute (Geiss, pp. 96-101).

Herring (1953, p. 31) reported that the findings of research studies dealing with the effects of instruction in high school bookkeeping upon students' achievement in college accounting disclosed that the students who had studied high school bookkeeping made better marks in elementary accounting than did those students who had not studied high school bookkeeping. In addition, he stated that students who had studied bookkeeping in the senior year of high school achieved more readily in the college elementary accounting courses than did those students who had studied bookkeeping in the sophomore and junior years of high school.

Carlin (1962) studied the effectiveness of intelligence, reading, and mathematics scores as predictors of success in four vocational high schools in New York City. He found a significant difference between intelligence scores of graduates and dropouts, but did not recommend that they be used alone for counselling. He found differences in arithmetic scores of graduates and dropouts to be consistently significant and substantial, and suggested that a critical arithmetic score would be the best single predictor of success in the vocational program. He also recommended that the school board include aptitude tests in their counselling battery in the future.

Karpoff (1967) attempted to identify the aptitude and achievement scores which would best predict success in the 22 Series Vocational courses offered at one large Alberta high school. His sample included the 646 students who completed one or more of the vocational 22 series courses at that high school in 1964, 1965 and 1966, and for whom complete data was available. The 27 predictor variables included the grade IX Departmental Examination scores, the D.A.T. battery scores, and

the Kuder Preference Record-Vocational. He set up regression equations for each of ten courses in the vocational 22 series courses, and found that between four and seven variables accounted for maximum variance in each case, which ranged from 29% to 69% of the criterion variance. His regression equation for electronics 22 scores (N = 86) resulted in an R = 0.728. The equation included four predictor variables, the grade IX science mark, the Kuder Computational Score, D.A.T. Verbal Reasoning score, and the Verbal Scat (Karpoff, p. 84).

Campbell (1966) investigated the predictive validity of grade IX Departmental scores at a vocational high school in Alberta. His sample consisted of the 443 students who completed one or more of the ten vocational courses offered by that school during the period 1963-1966 inclusive. Grade IX subjects which had the highest zero order correlations with final grades in a vocational subject were most often Science IX, Math IX, and Quatitive School and College Ability Test (QSCAT) (Campbell, p. 82) with the median highest single correlation coefficient being 0.424 (Campbell, p. 87). The average level of criterion variance explained by multiple regression equations for the individual subjects was found to be 29.25% which the investigator concluded was too low to justify their use over that of the single best predictor (Campbell, p. 76). This is probably especially true in the case where samples were small, the extreme case being where N = 12, and the predictor equation contained three predictor variables.

The vast majority of prediction studies have been concerned with the prediction of college performance, especially the prediction of first year college performance. The following is a review of some literature related to prediction of school and college performance

with an emphasis on studies which used data beyond the first year level.

Scott (1966, p. 370) investigated the correlations between high school grades and college performance in mathematics and science with data from the graduates of the University of Arkansas during the period 1960-1964. He concluded that the average achievement in all high school mathematics and science courses is an excellent predictor of freshman success in mathematics and science courses, a good predictor of sophomore success in mathematics and science, and a poor predictor of performance in junior and senior mathematics and science.

Lewis (1964, pp. 353-356) carried out a study to investigate the efficiency of pre-college variables for predicting grade point averages for students enrolled in the Iowa State University's College of Pharmacy in 1952, 1953 and 1954. Rank in high school class, high school G.P.A., the number of high school physical science units completed, and the percentile mathematics scores of the College Entrance Tests were used as predictors.

He found the multiple correlation coefficient between predictors and freshman G.P.A. to be 0.6. However, the validity of these predictors fell markedly as predictors of sophomore and junior achievement, and he used freshman G.P.A. and sophomore G.P.A. in his predictor equations for junior performance, which kept multiple R at the 0.6 to 0.7 level. He found that the freshman G.P.A. was a significant predictor of sophomore G.P.A.

Black (1960) carried out a series of studies related to the prediction of freshman success at the University of Alberta. In a study to determine the validities of grade IX Departmental grades for predicting freshman success, Black (1960, pp. 38-53) used the data from

529 students who entered the University of Alberta in 1956. He investigated the validity of grade XII Departmental marks, grade IX Departmental marks, S.C.A.T. scores, A.C.E. subtest scores, C.E.E.B. scores and S.A.T. scores for the prediction of freshman success.

He found the grade XII science average to have the largest zero order correlation with university average (r = 0.632) and a regression equation which combined the grade XII Departmental grades in English, Science average, Math average, Foreign Language and Social Studies, was deemed to be the best operational combination for all university courses studied (Black, p. 45). Multiple correlations reported with this combination of predictors was +0.656 for the whole group and 0.670 for that part of the group in engineering (Black, p. 46).

In a follow-up study, Black's (1964, pp. 125-136) regression equations were applied six years later to another sample of students entering engineering. The prediction equation was not found to shrink significantly.

Knowles and Black (1965, p. 125) studied the use of the Principal's Confidential Estimates of the Grade XII Departmental Examination results for prediction of freshman success, and found that the loss of predictive efficiency when principals' estimates are used in place of the actual Departmental scores was only 2.3%. This would seem to confirm Bloom's contention that teachers' grades were perhaps more accurate than are commonly credited.

Evanson and Smith (1958, pp. 67-83) reported the findings of a study wherein some of the correlates of university achievement were investigated with a sample from those who entered the University of Alberta as freshmen in 1951. Some of their findings pertinent to this

study are summarized in Tables I and II.

TABLE I

COEFFICIENTS OF CORRELATION (r) BETWEEN FIRST YEAR MARKS AT UNIVERSITY AND MARKS IN LATER YEARS (EVANSON AND SMITH, P. 70)

First Year Average with:	r	No. of Cases
Second year university average	0.63	510
Final year university average (students graduating in 3 years)	0.45	181
Final year university average (students graduating in 4 years)	0.47	199

TABLE II

COEFFICIENTS OF CORRELATION (r) BETWEEN GRADE XII AVERAGE SCORES AND UNIVERSITY MARKS OF 1951 FRESHMEN (EVANSON AND SMITH, P. 70)

Grade XII Average	r	No. of Cases
First year university average	0.48	881
Second year university average	0.54	478
Final year university average (students graduating in 3 years)	0.36	170
Final year university average (students graduating in 4 years)	0.50	191

The observation that the intercorrelations between achievement in the different years of university are quite low, and lower than that between the grade XII average in some cases is of particular interest in the findings of Evanson and Smith. However, it must be pointed out that comparisons between the correlations are somewhat risky in that different samples were used for each correlation. Furthermore, the study indicated that grade XII examinations of the Province of Alberta represent the best single predictor of success at the University of Alberta.

SUMMARY

1. A vast amount of prediction research has been done for estimating first year university achievement. However, very little research has been done in predicting success in the later college years.

2. The high school academic average seems to be a good predictor of freshman success in university and remains reasonably stable as a predictor of success over the length of the program.

3. There appears to be a scarcity of literature in the area of prediction studies for vocational and technical programs, especially as compared to the amount of literature relating to prediction of college success. Vocational and technical programs are generally more specialized and less academic than university programs. Further, the entrance requirements for vocational and technical schools are usually lower with respect to high school academic standing than are the entrance requirements of universities. This factor may well result in different student populations in the different institutions. Hence, good predictors of success in university programs are not necessarily valid

predictors of success in technical and vocational programs.

4. A combination of high school achievement scores and aptitude scores, as determined by multiple linear regression procedures, has often been found to predict up to 50% of the variance in freshman success.

5. Sometimes, simple combinations of predictor scores, such as averages, have been found to be as efficient for prediction as regression scores.

6. Certain subtests of the D.A.T. have been found to be significant predictors of success in college and technical programs.

7. Teachers' marks can be as effective for prediction purposes as standardized examinations which measure high school achievement.

CHAPTER III

PROCEDURE--DESIGN OF THE STUDY

Population and Sample

The population consisted of all students who have completed, those who are currently enrolled, and those who will take up the two year Electronics Program at the Northern Alberta Institute of Technology (N.A.I.T.). It is assumed that the student population has high school preparation equivalent to the school year 1970-1971 in Alberta and pursues equivalent programs during the two years in the N.A.I.T. Electronics program of September 1970. It is also assumed that the entrance requirements at N.A.I.T. do not differ from those which were in existence in September, 1970.

To replace the three year Electronics Program which had been terminated after September 1970, the two year Electronics Program has been introduced. Hence the sample consisted of all students who were admitted to the two year Electronics Program of N.A.I.T. during the two-year period, September 1970 to September 1971 and had completed the program by May 1972 and May 1973. Out of a total of 195 students, complete data were available for 146 students. Therefore, sample size for this study is 146.

Collection of Data

For each of the 146 students, the first and second year weighted final average marsk in the two year Electronics Program were obtained from the records of the Registrar's Office at N.A.I.T.

From the same records, student final marks were obtained for the following high school subjects: Industrial Arts Electronics 10, 20, 30; Electricity 12, 22, 32; Electronics 22, 32; English 30; Social Studies 30; Mathematics 30, 31, 33; Chemistry 30; Physics 30; French 30 and Biology 30. These marks were used either singly or jointlt in developing the predictors used in this study.

D.A.T. subtest scores (VR + NA) for the whole sample were procured from the official records of the Student Counselling Center. The test purports to measure the students' scholastic aptitude.

Treatment of Data

An identification number was assigned to each of the 146 students and a deck of IBM cards was punched from the information sheets to permit processing by a computer. The analysis was conducted through the Division of Educational Research Services and the data were processed at the Computing Science Centre at the University of Alberta.

Statistical Procedures

This is an observational study, not an experiment. The investigator did not draw random samples of students from an existing population, instead the sample was determined by the availability of data from N.A.I.T. In view of this lack of experimental control, it would not be surprising that the students of the sample differed initially in intelligence. Hence, there was a need to increase the precision of this study by removing the potential sources of bias dur to initial differences among students' intelligence. The Analysis of Covariance was considered most appropriate to accomplish this aim (Winer, 1971, pp. 752-812, and Ferguson, 1966, pp. 326-340).

The Analysis of Covariance was employed as a statistical control technique, to test the significance of the differences between group means of the first and second year Electronic final marks (the criterion), by taking into account and adjusting the initial scholastic aptitude differences measured by D.A.T. Subtest (the covariate).

An examination of the data to determine the size of each group revealed that twenty-one students had thirty-five credits of high school electricity; thirty-one students had five to twenty credits of high school electricity, twenty students had ten to twenty credits of high school electricity and ninety-four students had no high school electricity. Comparisons of these groups on both the first and second year final marks were made as follows:

1. Group A Those who had taken no electricity in high school (n=94).
   Group B Those who had taken thirty-five credits of high school electricity (n=21).
2. Group A Those who had taken no electricity in high school (n=94).
   Group C Those who had taken five to twenty credits of high school electricity (n=31).
3. Group A Those who had taken no electricity in high school (n=94).
   Group D Those who had taken ten to twenty credits of high school electricity (n=20).

The second method of analysis used was that of stepwise multiple regression by means of which the hypotheses in Part II were tested. This procedure provides the means and standard deviations of all predictor variables and criterion variables, and a correlation coefficients matrix showing the relationship between variables. At each step the accumulated variance, the beta weights and constants

associated with each variable, are provided enabling the development of multiple regression equations. The regression equation using the predictor with the highest zero order correlation with the criterion variable is determined first, the predictor which adds most to the multiple correlation coefficient is added to the regression equation in the next step, and so on. Percent of the criterion variance accounted for by the regression equation and the significance level of the regression equation (p 0.05) were also ascertained. The significance level is determined on the basis of an F test. In using three runs in this analysis a different number of predictors and, consequently, different N's were employed in each run. The correlation of each predictor with both the first and the second year Electronic final marks was determined. The predictors and N's used in the three separate analyses were as follows:

1. D.A.T. (VR+NA), English 30, Mathematics Average, Science Average, Departmental Average, Electricity or Electronics 22, and Electricity or Electronics 32 (n=19).
2. D.A.T. (VR + NA), English 30, Mathematics Average, Science Average Departmental Average, and Electricity 12 (or Electronics 10) (n=21).
3. D.A.T. (VR + NA), English 30, Mathematics Average, Science Average and Departmental Average (n=82).

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The results of the analysis of the data are presented in this chapter. Each null hypothesis of Parts I and II is stated and followed by the appropriate test and a brief interpretation.

Part I: Covariance Analysis

Hypothesis 1(a). There is no significant difference at the 0.05 level in the adjusted first year Electronics marks between students who have had thirty-five credits of electricity instruction in high school and students who have had no electricity instruction in high school.

Group A (N=94). Those students who have had no electricity instruction in high school.

Group B (N=21). Those students who have had thirty-five credits of electricity instruction in high school.

The mean first year Electronics mark before adjustment was 68.30 for Group A and 72.85 for Group B. After adjustment the mean was 68.20 for Group A and 73.28 for Group B. As shown in Table III the difference in mean achievement scores of the two groups was found to be significant at the 0.05 level. Therefore, hypothesis 1(a) was rejected. Students who have had thirty-five credits of electricity instruction in high school did achieve higher first year Electronics marks than did students who have had no electricity instruction in high school.

Hypothesis 1(b). There is no significant difference at the 0.05 level in the adjusted second year Electronics marks between students who

TABLE III

ANALYSIS OF COVARIANCE OF FIRST YEAR ELECTRONICS FINAL MARKS BETWEEN GROUP A (N=94) AND GROUP B (N=21)

Source of Variation	df	Mean Squares	Adjusted F	P
Group	1	441.69	5.605	0.020[a]
Within	112	78.80		

[a]Significant at the 0.05 level.

have had thirty-five credits of electricity instruction in high school and students who have had no electricity instruction in high school.

Group A (N=94). Those students who have had no electricity instruction in high school.

Group B (N=21), Those students who have had thirty-five credits of electricity instruction in high school.

The mean second year Electronics mark before adjustment was 67.08 for Group A and 67.38 for Group B. After adjustment the mean was 67.00 for Group A and 67.71 for Group B. As shown in Table IV, no significant difference in mean achievement scores was found. Therefore, hypothesis 1(b) was not rejected. There is no significant difference in the adjusted second year Electronics marks between students who have had thirty-five credits electricity instruction in high school and students who have had no electricity instruction in high school.

<u>Hypothesis 2(a)</u>. There is no significant difference at the 0.05 level in the adjusted first year Electronics marks between students who have had five to twenty credits of electricity instruction in high

TABLE IV

ANALYSIS OF COVARIANCE OF SECOND YEAR ELECTRONICS
FINAL MARKS BETWEEN GROUP A (N=94)
AND GROUP B (N=21)

Source of Variation	df	Mean Squares	Adjusted F	P
Group	1	8.80	0.095	0.758
Within	112	92.55		

school and students who have had no electricity instruction in high school.

Group A (N=94). Those students who have had no electricity instruction in high school.

Group C (N=31). Those students who have had five to twenty credits of electricity instruction in high school.

The mean first year Electronics mark before adjustment was 68.30 for Group A and 68.85 for Group C. After adjustment the mean was 68.11 for Group A and 69.42 for Group C. As shown in Table V, no significant difference in mean achievement scores was found. Therefore, hypothesis 2(a) was not rejected. There is no significant difference in the adjusted first year Electronics marks between students who have had five to twenty credits instruction in high school and students who have had no electricity instruction in high school.

<u>Hypothesis 2(b)</u>. There is no significant difference at the 0.05 level in the adjusted second year Electronics marks between students who have had five to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high

TABLE V

ANALYSIS OF COVARIANCE OF FIRST YEAR ELECTRONICS FINAL MARKS BETWEEN GROUP A (N=94) AND GROUP C (N=31)

Source of Variation	df	Mean Squares	Adjusted F	P
Group	1	39.48	0.592	0.443
Within	122	66.68		

school.

Group A (N=94). Those students who have had no electricity instruction in high school.

Group C (N=31). Those students who have had five to twenty credits of electricity instruction in high school.

The mean second year Electronics mark before adjustment was 67.08 for Group A and 65.96 for Group C. After adjustment the mean was 66.95 for Group A and 66.33 for Group C. As shown in Table VI, no significant difference in mean achievement scores was found. Therefore, hypothesis 2(b) was not rejected. There is no significant difference in the adjusted second year Electronics marks between students who have had five to twenty credits instruction in high school electricity and students who have had no electricity instruction in high school.

<u>Hypothesis 3(a)</u>. There is no significant difference at the 0.05 level in the adjusted first year Electronics marks between students who have had ten to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high

TABLE VI

ANALYSIS OF COVARIANCE OF SECOND YEAR ELECTRONICS
FINAL MARKS BETWEEN GROUP A (N=94)
AND GROUP C (N=31)

Source of Variation	df	Mean Squares	Adjusted F	P
Group	1	9.12	0.115	0.735
Within	122	79.01		

school.

Group A (N=94). Those students who have had no electricity instruction in high school.

Group D (N=20). Those students who have had ten to twenty credits of electricity instruction in high school.

The mean first year Electronics mark before adjustment was 68.30 for Group A and 71.56 for Group D. After adjustment the mean was 68.13 for Group A and 72.36 for Group D. As shown in Table VII the difference in mean achievement scores of the two groups was found to be significant at the 0.05 level. Therefore, hypothesis 3(a) was rejected. There is a significant difference in the adjusted first year Electronics marks between students who have had ten to twenty credits electricity instruction in high school and students who have had no electricity instruction in high school.

Hypothesis 3(b). There is no significant difference at the 0.05 level in the adjusted second year Electronics marks between students who have had ten to twenty credits of electricity instruction in high

TABLE VII

ANALYSIS OF COVARIANCE OF FIRST YEAR ELECTRONICS
FINAL MARKS BETWEEN GROUP A (N=94)
AND GROUP D (N=20)

Source of Variation	df	Mean Squares	Adjusted F	P
Group	1	289.77	4.199	0.043[a]
Within	111	69.01		

[a]Significant at the 0.05 level.

school and students who have had no electricity instruction in high school.

Group A (N=94). Those students who have had no electricity instruction in high school.

Group D (N=20). Those students who have had ten to twenty credits of electricity instruction in high school.

The mean second year Electronics mark before adjustment was 67.08 for Group A and 68.58 for Group D. After adjustment the mean was 66.95 for Group A and 69.16 for Group D. As shown in Table VIII, no significant difference in mean achievement scores was found. Therefore, hypothesis 3(b) was not rejected. There is no significant difference in the adjusted second year Electronics marks between students who have had ten to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

<u>Analysis of Covariance Summary (Table IX)</u>

With regard to first year Electronics final scores, Groups B,

TABLE VIII

ANALYSIS OF COVARIANCE OF SECOND YEAR ELECTRONICS FINAL MARKS BETWEEN GROUP A (N=94) AND GROUP D (N=20)

Source of Variation	df	Mean Squares	Adjusted F	P
Group	1	79.57	0.984	0.323
Within	111	80.88		

TABLE IX

PART I: SUMMARY OF ANALYSES OF COVARIANCE

Group	Adjusted Means First Year Electronics Final Differences	Adjusted Means Second Year Electronics Final Differences
A B	Significant[a]	Not Significant
A C	Not Significant	Not Significant
A D	Significant[a]	Not Significant

[a]Significant at the 0.05 level.

C and D achieved higher mean scores than Group A before adjustment had been made to partial out the effect of scholastic aptitude. However, after the adjustment, only Groups B and D scored significantly higher than Group A at the 0.05 level of confidence, with F ratios of 5.605 and 4.199 respectively.

When the second year Electronic scores were used for comparison, there were no significant differences between the means of Group A and those of Groups B, or C, or D, at the 0.05 level, before or after the adjustment.

<u>Part II: Stepwise Multiple Regression Analysis</u>

<u>Hypothesis 4(a)</u>. Including Electricity (or Electronics) 22 and 32 as predictors, there is no significant correlation, at the 0.05 level, between the first year Electronics final mark and marks in the following:

(1) English 30
(2) D.A.T. Subtest
(3) Mathematics Average
(4) Science Average
(5) Departmental Average
(6) Electricity (or Electronics) 22
(7) Electricity (or Electronics) 32

The means and standard deviations for scores on the seven predictor variables and two criteria variables are given in Table X. With N = 19, a correlation of 0.433 is required for significance at the 0.05 level. As shown in Table XI, D.A.T. Subtest, Mathematics Average and Departmental Average were significantly correlated with the first year Electronics final mark. Therefore, hypothesis 4(a) was rejected. The significant correlations were D.A.T. Subtest at 0.556, Mathematics Average at 0.462 and Departmental Average at 0.525.

To develop a regression equation which includes those variables which are the best predictors of the first year Electronics final mark, the stepwise multiple regression program was utilized. Table

TABLE X

MEANS AND STANDARD DEVIATIONS FOR SCORES ON SEVEN PREDICTOR VARIABLES AND TWO CRITERIA VARIABLES; N=19

Predictor Variables	Means	Standard Deviations
English 30	60.16	9.54
D.A.T. Subtest	67.53	10.52
Mathematics Average	65.58	9.93
Science Average	68.68	10.72
Departmental Average	65.26	8.47
Electricity (or Electronics) 22	77.11	11.34
Electricity (or Electronics) 32	71.68	12.25
Criterion Variables		
First year Electronics final	73.92	11.16
Second year Electronics final	67.14	11.93

TABLE XI

THE CORRELATION COEFFICIENTS OF SEVEN PREDICTOR VARIABLES WITH EACH OF TWO CRITERION VARIABLES; N=19

	Criterion	
Predictor	First Year Electronics Final	Second Year Electronics Final
1) English 30	0.316	0.394
2) D.A.T. (VR+NA)	0.556[a]	0.582[a]
3) Mathematics Average	0.462[a]	0.473[a]
4) Science Average	0.426	0.479[a]
5) Departmental Average	0.525[a]	0.567[a]
6) Electricity/Electronics 22	0.217	0.430
7) Electricity/Electronics 32	0.198	0.241

[a] Significant at the 0.05 level.

XII indicates that with N = 19, the D.A.T. Subtest was the best single predictor of the first year Electronics final mark accounting for 30.89 percent of the variance, followed by Departmental Average with 12.96 percent, English 30 with 6.72 percent, Science Average with 5.02 percent, Electricity (Electronics) 32 with 3.49 percent and Mathematics Average with 1.82 percent.

The resulting equation was derived from the model:

$$\hat{Y} = C + a_1X_1 + a_2X_2 + \ldots\ldots + a_nX_n$$

where $\hat{Y}$ is the predicted criterion

C is the constant associated with a particular set of weighted predictors

X_1 to X_n are the predictor variables

a_1 to a_n are the regression coefficients associated with each predictor.

The prediction equation for the first year Electronics final mark based on N = 19 and using the variables given in hypothesis 4(a) was as follows:

$$\hat{Y} = 9.262 + 0.533\ X_1 + 3.539\ X_2 - 0.328\ X_3 - 1.599\ X_4 - 0.719\ X_5 - 0.391\ X_6$$

where X_1 to X_6 are identified in Table XII.

As shown in Table XII, the regression equation is significant at the 0.05 level.

Hypothesis 4(b). Including Electricity (or Electronics) 22 and 32 as predictors, there is no significant correlation, at the 0.05 level, between the second year Electronics final mark and marks in the

TABLE XII

LAST SIGNIFICANT STEP IN THE STEPWISE MULTIPLE REGRESSION ANALYSIS TO DETERMINE THE BEST PREDICTORS OF THE FIRST YEAR ELECTRONICS MARK; N=19

Variable	Standard Weight	Regression Weight	Standard Error	Percent Variance
D.A.T. Subtest (X_1)	0.502	0.533	0.214	30.89
Departmental Average (X_2)	2.685	3.539	1.529	12.96
Electricity/Electronics 32 (X_3)	-0.360	-0.328	0.232	3.49
Science Average (X_4)	-1.535	-1.599	0.789	5.02
English 30 (X_5)	-0.615	-0.719	0.453	6.72
Mathematics Average (X_6)	-0.348	-0.391	0.524	1.82
			Total	60.90

Constant 9.262

SIGNIFICANCE OF REGRESSION

Source	df	Sums of Squares	Mean Squares	F	P
Regression	6	1366.47	227.75	3.114	0.044[a]
Residuals	12	877.30	73.11		
Total	18	2243.77			

[a]Significant at the 0.05 level.

following:

(1) English 30
(2) D.A.T. Subtest
(3) Mathematics Average
(4) Science Average
(5) Departmental Average
(6) Electricity (or Electronics) 22
(7) Electricity (or Electronics) 32.

As shown in Table XI, D.A.T. Subtest, Mathematics Average, Science Average and Departmental Average are significantly correlated with the second year Electronics final marks. Therefore, hypothesis 4(b) was rejected.

The significance level required for these correlations was 0.433. The significant correlation with the second year Electronics final marks were: D.A.T. Subtest at 0.582, Mathematics Average at 0.473, Science Average at 0.479 and Departmental Average at 0.567. As shown in Table XIII the best predictors of the second year Electronics final mark were: D.A.T. Subtest, Departmental Average, Science Average, Electricity (Electronics) 22, Electricity (Electronics) 32 and English 30, with variance accounted for of 33.83 percent, 15.65 percent, 3.23 percent, 3.13 percent, 2.77 percent and 1.96 percent respectively. The prediction equation for the second year final mark, based on N = 19 and using the variables given in hypothesis 5(b) was as follows:

$$\hat{Y} = -13.233 + 0.503\ X_1 + 2.163\ X_2 - 0.343\ X_3 - 1.026\ X_4 + 0.238\ X_5 - 0.293\ X_6$$

where X_1 to X_6 are indicated in Table XIII.

The regression equation is significant at the 0.05 level.

TABLE XIII

LAST SIGNIFICANT STEP IN THE STEPWISE MULTIPLE REGRESSION ANALYSIS TO DETERMINE THE BEST PREDICTORS OF THE SECOND YEAR ELECTRONICS MARK; N=19

Variable	Standard Weight	Regression Weight	Standard Error	Percent Variance
D.A.T. Subtest (X_1)	0.444	0.503	0.228	33.83
Departmental Average (X_2)	1.536	2.163	1.198	15.65
Electricity (Electronics) 32 (X_3)	-0.352	-0.343	0.255	2.77
Science Average (X_4)	-0.922	-1.026	0.794	3.23
Electricity (Electronics) 22 (X_5)	0.221	0.238	0.232	3.13
English 30 (X_6)	-0.234	-0.293	0.380	1.96
			Total	60.57

Constant -13.233

SIGNIFICANCE OF REGRESSION

Source	df	Sums of Squares	Mean Squares	F	P
Regression	6	1551.67	258.61	3.073	0.046[a]
Residuals	12	1009.94	84.16		
Total	18	2561.61			

[a]Significant at the 0.05 level.

Hypothesis 5(a). Including Electricity 12 (or Electronics 10) as a predictor, there is no significant correlation at the 0.05 level, between the first year Electronics final mark and marks in the following:

(1) Electricity 12 (or Electronics 10)
(2) English 30
(3) D.A.T. Subtest
(4) Mathematics Average
(5) Science Average
(6) Departmental Average

The means and standard deviations for scores on the six predictor variables and two criterion variables are given in Table XIV. With N = 21, a correlation of 0.413 is required for significance at the 0.05 level. As shown in Table XV, Mathematics Average, Science Average and Departmental Average are significantly correlated with the first year Electronics final marks. Therefore, hypothesis 6(a) was rejected.

The significant correlations were Mathematics Average at 0.546, Science Average at 0.435, and Departmental Average at 0.536. As shown in Table XVI, the best predictors of the first year Electronics final mark were: Mathematics Average, D.A.T. Subtest, Electricity 12 (or Electronics 10), Departmental Average and English 30, with variance accounted for of 29.82 percent, 13.92 percent, 5.52 percent, 2.73 percent and 1.00 percent respectively. The prediction equation for the first year final mark, based on N = 21 and using the variables given in hypothesis 5(a) was as follows:

$$\hat{Y} = -1.507 + 0.642\ X_1 + 0.258\ X_2 + 0.257\ X_3 + 0.300\ X_4 - 0.474\ X_5$$

where X_1 to X_5 are indicated in Table XVI.

The regression equation is significant at the 0.05 level.

TABLE XIV

MEANS AND STANDARD DEVIATIONS FOR SCORES ON SIX PREDICTOR VARIABLES AND TWO CRITERION VARIABLES; N=21

Predictor Variables	Means	Standard Deviations
Electricity 12 (or Electronics 10)	81.24	9.68
English 30	62.24	9.13
D.A.T. Subtest	70.24	10.33
Mathematics Average	70.14	10.07
Science Average	68.57	10.59
Departmental Average	67.10	7.44
Criterion Variables		
First year Electronics final	69.46	7.17
Second year Electronics final	66.37	6.70

TABLE XV

THE CORRELATION COEFFICIENTS OF SIX PREDICTOR VARIABLES WITH EACH OF TWO CRITERION VARIABLES; N=21

	Criterion	
Predictor	First Year Electronics Final	Second Year Electronics Final
1) Electricity 12/Electronics 10	0.151	0.159
2) English 30	0.298	0.008
3) D.A.T. Subtest	0.361	-0.050
4) Mathematics Average	0.546[a]	0.565[a]
5) Science Average	0.435[a]	0.285
6) Departmental Average	0.536[a]	0.386

[a]Significant at the 0.05 level.

TABLE XVI

LAST SIGNIFICANT STEP IN THE STEPWISE MULTIPLE REGRESSION ANALYSIS TO DETERMINE THE BEST PREDICTORS OF THE FIRST YEAR ELECTRONICS MARK; N=21

Variable	Standard Weight	Regression Weight	Standard Error	Percent Variance
Mathematics Average (X_1)	0.902	0.642	0.280	29.82
D.A.T. Subtest (X_2)	0.372	0.258	0.134	13.92
Electricity 12/Electronics 10 (X_3)	0.348	0.257	0.166	5.52
English 30 (X_4)	0.383	0.300	0.276	1.00
Departmental Average (X_5)	-0.492	-0.474	0.508	2.73
			Total	52.99

Constant -1.507

SIGNIFICANCE OF REGRESSION

Source	df	Sums of Squares	Mean Squares	F	P
Regression	5	544.64	108.93	3.381	0.0304[a]
Residuals	15	483.27	32.22		
Total	20	1027.91			

[a]Significant at the 0.05 level.

Hypothesis 5(b). Including Electricity 12 (or Electronics 10) as a predictor, there is no significant correlation, at the 0.05 level, between the second year Electronics final mark and marks in the following:

(1) Electricity 12 (or Electronics 10)
(2) English 30
(3) D.A.T. Subtest
(4) Mathematics Average
(5) Science Average
(6) Departmental Average

As shown in Table XV, Mathematics Average is significantly correlated with the second year Electronics final marks. Therefore, hypothesis 5(b) was rejected.

The significance level required for this correlation was 0.413. The significant correlation of Mathematics Average with the second year Electronics final marks was 0.565. As shown in Table XVII the best predictors of the second year Electronics final marks were: Mathematics Average, Electricity 12 (or Electronics 10) and Departmental Average, with variance accounted for of 31.87 percent, 5.75 percent and 1.07 percent respectively. The prediction equation for the second year final mark, based on N = 21, and using the variables given in hypothesis 5(b) was as follows:

$$\hat{Y} = 26.259 + 0.471\, X_1 + 0.201\, X_2 - 0.139\, X_3$$

where X_1 to X_3 are indicated in Table XVII.
The regression equation is significant at the 0.05 level.

Hypothesis 6(a). Excluding students who have high school electricity courses as predictors, there is no significant correlation, at the 0.05 level, between the first year Electronics final mark and

TABLE XVII

LAST SIGNIFICANT STEP IN THE STEPWISE MULTIPLE REGRESSION ANALYSIS TO DETERMINE THE BEST PREDICTORS OF THE SECOND YEAR ELECTRONICS MARK; N=21

Variable	Standard Weight	Regression Weight	Standard Error	Percent Variance
Mathematics Average (X_1)	0.709	0.471	0.186	31.87
Electricity 12 (or Electronics 10) (X_2)	0.291	0.201	0.147	5.75
Departmental Average (X_3)	-0.155	-0.139	0.255	1.07
			Total	38.69

Constant 26.259

SIGNIFICANCE OF REGRESSION

Source	df	Sums of Squares	Mean Squares	F	P
Regression	3	346.85	115.62	3.575	0.0360[a]
Residuals	17	549.71	32.34		
Total	20	896.56			

[a]Significant at the 0.05 level.

marks in the following:

(1) English 30

(2) D.A.T. Subtest

(3) Mathematics Average

(4) Science Average

(5) Departmental Average

The means and standard deviations for scores on the five predictor variables and two criterion variables are given in Table XVIII. With N = 82, a correlation of 0.215 is required for significance at the 0.05 level. As shown in Table XIX, D.A.T. Subtest, Mathematics Average, Science Average and Departmental Average are significantly correlated with the first year Electronics final mark. Therefore, hypothesis 6(a) was rejected.

The significant correlations were D.A.T. Subtest at 0.362, Mathematics Average at 0.395, Science Average at 0.431 and Departmental Average at 0.473. As shown in Table XX, the best predictors of the first year Electronics final mark were: Departmental Average, D.A.T. Subtest and English 30, with variance accounted for of 22.40 percent, 6.35 percent and 1.50 percent respectively. The prediction equation for the first year final mark, based on N = 82 and using the variables given in hypothesis 6(a) was as follows:

$$\hat{Y} = 26.218 + 0.499\ X_1 + 0.237\ X_2 - 0.113\ X_3$$

where X_1 to X_3 are indicated in Table XX.

the regression equation is significant at the 0.05 level.

<u>Hypothesis 6(b)</u>. Excluding students who have high school electricity courses as predictors, there is no significant correlation, at the 0.05 level, between the second year Electronics final mark and marks in the following:

TABLE XVIII

MEANS AND STANDARD DEVIATIONS FOR SCORES ON FIVE PREDICTOR VARIABLES AND TWO CRITERION VARIABLES; N=82

Predictor Variables	Means	Standard Deviations
English 30	60.18	11.50
D.A.T. Subtest	70.44	11.16
Mathematics Average	66.76	11.34
Science Average	65.51	11.32
Departmental Average	64.33	8.49
Criterion Variables		
First year Electronics final	68.17	9.04
Second year Electronics final	66.53	9.86

TABLE XIX

THE CORRELATION COEFFICIENTS OF FIVE PREDICTOR VARIABLES WITH EACH OF TWO CRITERION VARIABLES; N=82

	Criterion	
Predictor	First year Electronics final	Second year Electronics final
1) English 30	0.172	0.201
2) D.A.T. Subtest	0.362[a]	0.222[a]
3) Mathematics Average	0.395[a]	0.456[a]
4) Science Average	0.431[a]	0.410[a]
5) Departmental Average	0.473[a]	0.540[a]

[a] Significant at the 0.05 level.

TABLE XX

LAST SIGNIFICANT STEP IN THE STEPWISE MULTIPLE REGRESSION ANALYSIS TO DETERMINE THE BEST PREDICTORS OF THE FIRST YEAR ELECTRONICS MARK; N=82

Variable	Standard Weight	Regression Weight	Standard Error	Percent Variance
Departmental Average (X_1)	0.468	0.499	0.115	22.40
D.A.T. Subtest (X_2)	0.292	0.237	0.082	6.35
English 30 (X_3)	-0.143	-0.113	0.087	1.50
			Total	30.25

Constant 26.218

SIGNIFICANCE OF REGRESSION

Source	df	Sums of Squares	Mean Squares	F	P
Regression	3	2004.75	668.25	11.277	0.0000[a]
Residuals	78	4621.97	59.26		
Total	81	6626.72			

[a]Significant at the 0.05 level.

(1) English 30

(2) D.A.T. Subtest

(3) Mathematics Average

(4) Science Average

(5) Departmental Average

As shown in Table XIX, D.A.T. Subtest, Mathematics Average, Science Average and Departmental Average are significantly correlated with the second year Electronics final marks. Therefore, hypothesis 6(b) was rejected.

The significance level required for these correlations was 0.215. The significant correlations with the second year Electronics final mark were: D.A.T. Subtest at 0.222, Mathematics Average at 0.456, Science Average at 0.410 and Departmental Average at 0.540. As shown in Table XXI the best predictors of the second year Electronics final marks were: Departmental Average, Mathematics Average and D.A.T. Subtest, with variance accounted for of 29.15 percent, 0.87 percent and 0.81 percent respectively. The prediction equation for the second year final mark, based on N = 82 and using the variables given in hypothesis 6(b) was as follows:

$$\hat{Y} = 21.014 + 0.464\ X_1 + 0.101\ X_2 + 0.128\ X_3$$

where X_1 to X_3 are indicated in Table XXI.

The regression equation is significant at the 0.05 level.

TABLE XXI

LAST SIGNIFICANT STEP IN THE STEPWISE MULTIPLE REGRESSION ANALYSIS TO DETERMINE THE BEST PREDICTORS OF THE SECOND YEAR ELECTRONICS MARK; N=82

Variable	Standard Weight	Regression Weight	Standard Error	Percent Variance
Departmental Average (X_1)	0.400	0.464	0.177	29.15
D.A.T. Subtest (X_2)	0.114	0.101	0.088	0.81
Mathematics Average (X_3)	0.147	0.128	0.129	0.87
			Total	30.83
Constant	21.014			

SIGNIFICANCE OF REGRESSION

Source	df	Sums of Squares	Mean Squares	F	P
Regression	3	2427.44	809.15	11.589	0.0000[a]
Residuals	78	5445.77	69.82		
Total	81	7873.21			

[a]Significant at the 0.05 level.

Analysis of Stepwise Multiple Regression Summary

For students who had taken thirty-five credits of high school electricity instruction, the best predictor of success for the first and second year Electronics final marks was the D.A.T. Subtest which accounted for 30.89 and 33.83 percent of the variance respectively. If however, each of the following predictors, the first year, D.A.T. Subtest, Departmental Average, Electricity/Electronics 32, Science Average, English 30, Mathematics Average; the second year, D.A.T. Subtest, Departmental Average, Electricity/Electronics 32, Science Average, Electricity/Electronics 22, English 30 was used in the regression equation, success could be predicted with 60.90 percent, 60.57 percent of the variance respectively accounted for.

For students who had taken Electricity 12 or Electronics 10, the best predictor of success for the first and second year Electronic final marks was Mathematics Average which accounted for 29.82 and 31.87 percent of the variance respectively. If however, each of the following predictors, the first year, Mathematics Average, D.A.T. Subtest, Electricity 12 or Electronics 10, Departmental Average, English 30, the second year, Mathematics Average, Electricity 12 or Electronics 10, Departmental Average was used in the regression equation, success could be predicted with 52.99 percent, 38.69 percent of the variance respectively accounted for.

For students who had no high school electricity courses, the best predictor of success for the first and second year Electronic final marks was Departmental Average which accounted for 22.40 and 29.15 percent of the variance respectively. If however, each of the following predictors, the first year, Departmental Average, D.A.T.

Subtest, English 30, the second year, Departmental Average, D.A.T. Subtest, Mathematics Average was used in the regression equation, success could be predicted with 30.25 percent, 30.83 percent of the variance respectively accounted for.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The summary and conclusions presented in this chapter are reported in two sections. Part I includes the summary and conclusions related to the determination of the effect of prior electricity instruction upon achievement in two year Electronic Technology programs; Part II includes the summary and conclusions related to the selection of predictors of Electronic Technology.

PART I: SUMMARY AND CONCLUSIONS

Summary

One of the purposes of this study was to determine whether there is any difference in achievement of final marks in the N.A.I.T. Electronic Technology program between students who had received electricity instruction in high school and students who had not received such prior high school electricity instruction. Electronic Technology students enrolled at the Northern Alberta Institute of Technology from 1970 to 1973 were used as the sample. Of the 146 students included in the study, twenty-one students had received thirty-five credits, thirty-one students had received five to twenty credits, twenty students had received ten to twenty credits, of high school electricity instruction and ninety-four students had received no high school electricity instruction. In order to partial out the effect of intelligence the analysis of covariance method was employed which provided adjusted Electronics final marks. A summary of the results follows:

<u>Hypothesis 1(a)</u>. Hypothesis 1(a) was rejected. There is significant difference at the 0.05 level in the adjusted first year Electronics final marks between students who have had thirty-five credits of electricity instruction in high school and students who have had no electricity instruction in high school. Students who had received thirty-five credits of high school electricity instruction had an adjusted mean of 5.08 percentage points higher on their first year Electronics final marks than did those students who had received no high school electricity instruction.

<u>Hypothesis 1(b)</u>. Hypothesis 1(b) was not rejected. There is no significant difference at the 0.05 level in the adjusted second year Electronics final marks between students who have had thirty-five credits of electricity instruction in high school and students who have had no electricity instruction in high school.

<u>Hypothesis 2(a)</u>. Hypothesis 2(a) was not rejected. There is no significant difference at the 0.05 level in the adjusted first year Electronics final marks between students who have had five to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

<u>Hypothesis 2(b)</u>. Hypothesis 2(b) was not rejected. There is no significant difference at the 0.05 level in the adjusted second year Electronics final marks between students who have had five to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

<u>Hypothesis 3(a)</u>. Hypothesis 3(a) was rejected. There is

significant difference at the 0.05 level in the adjusted first year Electronics final marks between students who have had ten to twenty credits of electricity instruction in high school and students who have no electricity instruction in high school. Students who had received ten to twenty credits of electricity instruction in high school had an adjusted mean of 5.08 percentage points higher on their first year Electronics final marks than did those students who had received no electricity instruction in high school.

Hypothesis 3(b). Hypothesis 3(b) was not rejected. There is no significant difference at the 0.05 level in the second year Electronics final marks between students who have had ten to twenty credits of electricity instruction in high school and students who have had no electricity instruction in high school.

Conclusions

On the basis of the statistical analysis of the data obtained in this investigation, the following conclusions were made in relation to Part I of this study.

A significant difference was found between the first year Electronics final marks obtained by students who had previously completed a vocational program of electricity or electronics courses and those obtained by students who had not completed any electricity or electronics courses. In the sample used, students who had completed the vocational electricity or electronics program identified in this study achieved higher mean scores on the first year N.A.I.T. Electronics final marks than students who had no high school electricity instruction.

A significant difference was found between the first year Electronics final marks obtained by students who had previously completed some electricity or electronics courses and those obtained by students who had not completed any electricity or electronics courses. In the sample used, students who had completed two or more courses of electricity either in the Industrial Arts or Vocational Programs achieved higher mean scores on the first year N.A.I.T. Electronics final marks than students who had no high school electricity instruction.

In this sample, students who had taken two or more high school courses of electricity had higher mean achievement scores in the first year N.A.I.T. Electronics final marks than students who had only one course of high school electricity instruction. However by the end of the second year, this difference was no longer apparent. Similarly, there was no apparent difference between students who had completed a high school vocational program and those who had no high school electricity or electronics instruction at the end of the second year.

PART II: SUMMARY AND CONCLUSIONS

Summary

The second purpose of this study was to determine from a number of variables, the best predictors of the academic success of students of the first and second year Electronic Technology program at the Northern Alberta Institute of Technology. The factors considered were as follows: Electricity 12 (or Electronics 10), Electricity 22 (or Electronics 22 and 32), English 30, D.A.T. Subtest, Mathematics Average, Science Average and Departmental Average. The sample of 146 students was the same group used in Part I of this study and consisted

of Electronic Technology students enrolled at the Northern Alberta Institute of Technology from 1970 to 1973. The stepwise multiple regression computer program was used for the analysis.

In the first computer analysis when Electricity or Electronics 22 and Electricity or Electronics 32 were included as predictors (n=19), the correlation coefficient required for significance at the 0.05 level was 0.433. Three predictors correlated significantly with the criterion, first year Electronics final mark. The predictors and their respective correlation coefficients were as follows: D.A.T. Subtest with 0.556, Departmental Average with 0.525 and Mathematics Average at 0.462. Hence it was reasonable and possible to develop a prediction equation for the first year Electronics final mark as follows:

$$\hat{Y} = 9.262 + 0.533\ (\text{DAT}) + 3.539\ (\text{Dept. Avg}) - 0.328\ (\text{Elec } 32) - 1.599\ (\text{Science Avg}) - 0.719\ (\text{English } 30) - 0.391\ (\text{Math Avg})$$

Total variance accounted for = 60.90%

The D.A.T. Subtest was selected as the best predictor. It accounted for 20.89 percent of the variance. The next best predictors and the amount of variance that was added were Departmental Average with 12.96 percent, Electricity (or Electronics) 32 with 3.49 percent, Science Average with 5.02 percent, English 30 with 6.72 percent and Mathematics Average with 1.82 percent. Electricity (or Electronics) 22 did not contribute significantly to the equation and therefore are not reported here.

With the second year Electronics final mark as the criterion (N=19), the same three predictors that were significantly correlated

with the first year Electronics final mark again were significantly correlated with the second year Electronics final mark but one more variable was added. The predictors and their respective correlation coefficients were as follows: D.A.T. Subtest with 0.582, Departmental Average with 0.567 and Mathematics Average with 0.473. In addition, one more predictor, Science Average, produced a significant correlation of 0.479. The prediction equation for the second year Electronics final mark was written as:

$$\hat{Y} = -13.233 + 0.503\,(\text{DAT}) + 2.163\,(\text{Dept Avg}) - 0.343\,(\text{Elec } 32)$$
$$-1.026\,(\text{Science Avg}) + 0.238\,(\text{Elec } 22) - 0.293\,(\text{English } 30)$$

Total variance accounted for = 60.57%

The D.A.T. Subtest again was selected as the best predictor. It accounted for 33.83 percent of the variance. The next best predictors and the amount of variance that was added were Departmental Average with 15.65 percent, Electricity (or Electronics) 32 with 2.77 percent, Science Average with 3.23 percent, Electricity (or Electronics) 22 with 3.13 percent and English 30 with 1.96 percent.

In the second computer analysis when Electricity 12 or Electronics 10 was included as a predictor (N=21), the correlation coefficient required for significance was 0.413. Three predictors correlated significantly with the criterion, first year Electronics final mark. The predictors and their respective coefficients were as follows: Mathematics Average with 0.546, Departmental Average with 0.536 and Science Average with 0.435. Thus, it was justifiable to yield a prediction equation for the first year Electronics final mark:

$$\hat{Y} = -1.507 + 0.642\ (\text{Math Avg}) + 0.258\ (\text{DAT}) + 0.257\ (\text{Elec } 12/\text{Elec } 10) + 0.300\ (\text{English } 30) - 0.474\ (\text{Dept Avg})$$

Total variance accounted for = 52.99%

The Mathematics Average was selected as the best predictor when the regression equation for the first year Electronics final mark was established. It accounted for 29.82 percent of the variance. The next best predictors and the amount of variance that was added were D.A.T. Subtest with 13.92 percent, Electricity 12 (or Electronics 10) with 5.52 percent, Departmental Average with 2.73 percent, and English 30 with 1.00 percent.

With the second year Electronics final mark as the criterion (N=21), the only significant predictor was Mathematics Average with a correlation coefficient of 0.565. The prediction equation for the second year Electronics final mark was:

$$\hat{Y} = 26.259 + 0.471\ (\text{Math Avg}) + 0.201\ (\text{Elec } 12/\text{Elec } 10) -0.139\ (\text{Dept Avg})$$

Total variance accounted for = 38.69%

The Mathematics Average was again selected as the best predictor. It accounted for 31.87 percent of the variance when the regression equation was established. The next best predictors and the amount of variance that was added were Electricity 12 (or Electronics 10) with 5.75 percent and Departmental Average with 1.07 percent respectively.

In the final computer analysis when high school electricity instructions were deleted as predictors (N=82), the correlation coefficient required for significance was 0.215. Because of the large N a low significance was required and, as a result, all predictors

except English 30 were significantly correlated with both the first and second year Electronics final marks. The predictors of the first year Electronics final mark and their respective correlation coefficients were as follows: Departmental Average with 0.473, Science Average with 0.431, Mathematics Average with 0.395 and D.A.T. Subtest with 0.362. The predictors of the second year Electronics final mark and their respective correlation coefficients were as follows: Departmental Average 0.540, Mathematics Average 0.456, Science Average 0.410 and D.A.T. Subtest 0.222. Therefore, it was reasonable and possible to establish the prediction equation for the first year Electronics final mark as:

$$\hat{Y} = 26.218 + 0.499\ (\text{Dept Avg}) + 0.237\ (\text{DAT}) - 0.143\ (\text{English 30})$$

Total variance accounted for = 30.25%

The variables that added significantly to the prediction equation established for the first year Electronics final mark and the amount of variance that their addition accounted for were as follows: Departmental Average 22.40 percent, D.A.T. Subtest 6.35 percent and English 30 1.50 percent.

The prediction equation developed for the second year Electronics final mark was as follows:

$$\hat{Y} = 21.014 + 0.464\ (\text{Dept Avg}) + 0.101\ (\text{DAT}) + 0.218\ (\text{Math Avg})$$

Total variance accounted for = 30.83%

The variables that added significantly to the prediction equation established for the second year Electronics final mark and the amount of variance that their addition accounted for were as follows:

Departmental Average 29.15 percent, D.A.T. Subtest 0.81 percent and Mathematics Average 0.87 percent.

Departmental Average accounted for the largest portion of the variance followed by D.A.T. Subtest for both the prediction equations of the first and second year.

Conclusions

On the basis of the findings of this study the following conclusions related to Part II of the study seem tenable:

The best predictors of success in the N.A.I.T. Electronics Program for students who have completed the high school Vocational Electricity or Electronics Program are as follows: the first year of the N.A.I.T. Program, D.A.T. Subtest, Departmental Average, English 30, Science Average, Electricity/Electronics 32 and Mathematics Average. For the second year the best predictors are: D.A.T. Subtest, Departmental Average, Science Average, Electricity/Electronics 22, Electricity/Electronics 32 and English 30.

For students who have only one course of Electricity/Electronics in high school, the best predictors of success in the N.A.I.T. Electronics Program are as follows: the first year of the N.A.I.T. Program, Mathematics Average, D.A.T. Subtest, Electricity 12 or Electronics 10, Departmental Average and English. For the second year, the best predictors are: Mathematics Average, Electricity 12 or Electronics 10, and Departmental Average.

For students who have no high school Electricity courses, the best predictors of success in the N.A.I.T. Electronics Program are as follows: first year of the N.A.I.T. Program, Departmental Average,

D.A.T. Subtest, and English 30. For the second year, the best predictors are: Departmental Average, D.A.T. Subtest and Mathematics Average.

The variance accounted for in the regression equations presented in this study ranges from a high of about 60 percent to a low of about 30 percent. The variance accounted for appears to increase with the amount of prior training in electronics and decrease with the prediction of success in the second year. This compares favorably with other studies of regression analysis where the variance accounted for generally falls between 20 percent and 50 percent of the total variance. Lavin (1965), suggests that total variance accounted for ranging between 35 percent and 45 percent results in equations satisfactory for use in predicting student achievement. This being the case the equations developed in this study for students who have completed one or more courses of electricity while in high school might be used as predictors with some confidence while those equations associated with students who have had no training prior to entering N.A.I.T. may not be used with the same degree of confidence.

RECOMMENDATIONS

On the grounds of the findings of this study, the following recommendations are made:

1. It appears that students who have a background of two or more courses or thirty-five credits in high school electricity have an advantage over other students enrolled in the first year Electronics program at the Northern Alberta Institute of Technology. Guidance counsellors and other educators could inform students who wish to

select electronics at N.A.I.T. of the relationship between high school electricity instruction and the N.A.I.T. Electronics program. The prediction equations developed in this study might enable educators to assist students in making vocational choices.

2. Although students with some high school electricity instruction achieved significantly higher marks in the first year Electronics final than did those without such instruction, the correlation between high school electricity courses and the Electronics final marks was not large. Perhaps the marks assigned to high school electricity students does not assess adequately that characteristic which enables a high school electricity graduate to succeed in the N.A.I.T. first year Electronics program. Further investigation is required in this area.

3. A study should be made to determine the areas of similarity in content between high school electricity courses and the N.A.I.T. Electronic Technology program. A comparison should also be made of the instructional approach used in high school electricity courses with that used in the N.A.I.T. Electronic Technology program.

4. A further study should be conducted to verify the validity of the prediction equations developed in this research.

5. A survey should be conducted of Electronic Technology program students who have had prior electricity high school instruction to obtain students' reasons for stating that prior high school electricity instruction was, or was not, of assistance.

6. A further survey of Electronic Technology students could be conducted to determine the source of their difficulties in the Electronic Technology courses.

7. Data were only available for students who first enrolled in the program in 1970 and 1971 and who therefore graduated in 1972 and 1973. Factors of particular interest which could not be analyzed with reliability because of small numbers in the sample subgroups in this study could be later analyzed with substantially larger samples. Increasingly larger additions to the original sample occur annually. In those areas, this study could be considered a pilot study.

BIBLIOGRAPHY

BIBLIOGRAPHY

Ayers, Jerry B., Bustamante, Florinda A. and Phillip J. Campana. "Prediction of Success in College Foreign Language Courses." Educational and Psychological Measurement, 1973, Vol. 33, pp. 939-42.

Bae, Agnes Y. "The Prediction of the Learning of Chemistry Among 11th Grade Girls Through the Use of Stepwise and Doolittle Techniques," Educational and Psychological Measurement, Vol. 27, No. 4, 1967.

Black, Donald B. "The Prediction of Freshman Success in the University of Alberta from Grade XII Departmental Results," Alberta Journal of Educational Research, Vol. VI, March, 1960.

Black, Donald B. "Validity of Regression Equations After Six Years to Predict Freshman Success in Engineering," Alberta Journal of Educational Research, Vol. II, No. 2, 1965.

Black, Donald B. and Donald W. Knowles. "The Effectiveness of the Grade XII Principals' Rating Scores to Predict Freshman Success at the University of Alberta," Alberta Journal of Educational Research, Vol. II, No. 2, 1965, pp. 125-33.

Bloom, Benjamin S. Taxonomy of Educational Objectives, Handbook 1. Toronto: Longmans, Green and Company, 1956.

Bloom, Benjamin S. and Frank R. Peters. The Use of Academic Prediction Scales for Counselling and Selecting College Entrants. New York: Free Press of Glenco, 1961.

Brogdon, Hubert E. "On the Interpretation of the Correlation Coefficient as a Measure of Predictive Validity," Journal of Educational Psychology, Vol. 37, No. 2, 1946.

Campbell, Theodore R. "Grade Nine Marks as Predictor Criteria for Success in Selected Vocational Subjects." Unpublished Master's Thesis, University of Alberta, Edmonton, Alberta, September, 1966.

Carlin, Francis X. "Intelligence, Reading and Arithmetic Scores as Predictors of Success in Selected Vocational Schools." Doctoral Dissertation, Fordham University, 1962. (Microfilmed.)

Clarke, S. C. T. "Review of Some Previous Studies on Matriculation Problems." Alberta Journal of Educational Research, Vol. 4, 1958, pp. 30-39.

Checkley, S. M. Interview on April 9, 1974.

Department of Education, Alberta. Program of Studies for Senior High Schools. Edmonton, Alberta, 1970.

Department of Education, Alberta. Senior High School Handbook, 1972-73. Edmonton: Queen's Printer.

Department of Education, Alberta. Junior-Senior High School Handbook, 1973-74. Edmonton: Queen's Printer.

Division of Educational Research Services (D.E.R.S.). Computer Program Documentation. Edmonton: University of Alberta, 1968.

Draper, N. R. and H. Smith. Applied Regression Analysis. New York: John Wiley & Sons, Inc., 1966.

Evanson, A. B. and D. E. Smith. "A Study of Matriculation in Alberta," Alberta Journal of Educational Research, Vol. 4, No. 2, 1958, pp. 67-83.

Ferguson, George A. Statistical Analysis in Psychology and Education. Second Edition. Toronto: McGraw-Hill Book Company, 1966.

Gage, N. L. (ed.). Handbook of Research on Teaching. Chicago: Rand-McNally & Company, 1963.

Geiss, Almon L. "An Analysis of Relationships Between Courses Taken in High School and Success in Specific Areas at the Oregon Technical Institute." Unpublished Doctoral Dissertation, Washington State University, 1966. (Microfilmed.)

Guilford, J. P. Fundamental Statistics in Psychology and Education. Fourth Edition. Toronto: McGraw-Hill Book Company, 1965.

Herring, Virgil J. "Research Findings Relative to Students' Achievement in Bookkeeping and Accounting," Business Education Forum, Vol. 8, No. 1, October, 1953.

Karpoff, John T. "Aptitudes for Achievement in the Vocational Programs of One Composite High School in Alberta." Unpublished Master's Thesis, The University of Alberta, Edmonton, 1967.

Klugh, Henry E. and Robert Bierley. "The School and College Ability Test and High School Grades as Predictors of College Achievement," Educational and Psychological Measurement, Vol. 14, No. 4, 1959.

Lavin, David E. The Prediction of Academic Performance: A Theoretical Analysis and Review of Research. New York: Russel Sage Foundation, 1965.

Laws, Norman G. "Mathematical Expectations of Technicians in Michigan Industries," a Special Vocational Education Research Project. Michigan: Department of Public Instruction, 1966.

Lewis, John W. "Utilizing the Stepwise Multiple Regression Procedure in Selecting Predictor Variables by Sex Group," Educational and Psychological Measurement, Vol. 22, No. 2, 1962, pp. 353-56.

MacDonald, Edgar E. G. "Prediction of University Success in Years After the First." Unpublished Master's Thesis, University of Alberta, Edmonton, Spring, 1970.

Richards, James M. Jr. "Prediction of Choice of and Success in Agriculture as a College Major," Educational and Psychological Measurement, Vol. 31, 1971, pp. 505-12.

Richards, James M. Jr., John L. Holland, and Sandra W. Lutz. "Prediction of Student Accomplishment in College," Journal of Educational Psychology, Vol. 58, No. 6, 1967, pp. 343-55.

Rozeboom, William W. Foundations of the Theory of Prediction. Homewood, Illinois: The Dorsey Press, 1966.

Scott, Ralph L. "The Relationship Between Achievement in High School and Success in College with Reference to Science and Mathematics." Doctoral Dissertation, University of Arkansas, 1966. (Microfilmed.)

Smilanich, Robert. "An Inquiry into the Use of Multiple Discriminant Analysis in Vocational Guidance." Unpublished Master's Thesis, University of Alberta, Edmonton, October, 1966.

Spaulding, Helen. "The Prediction of First-year Grade Averages in a Private Junior College," Educational and Psychological Measurement, Vol. 19, No. 4, 1959, pp. 627-28.

Vineyard, E. E. "Longitudinal Study of the Relationship of Differential Aptitude Test Scores with College Success," Personnel and Guidance Journal, Vol. 36, 1958, pp. 413-16.

Weber, Larry, Mary Frances King and George Pitts. "Predicting Success in Schools of Practical Nursing," Educational and Psychological Measurement, Vol. 33, 1973, pp. 943-45.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill Book Company, 1971.

Wolins, Leroy. "The Use of Multiple Regression Procedures When the Variables are Psychological Tests," Educational and Psychological Measurement, Vol. 27, No. 4, 1967.

Zurowsky, John. "Predicting Freshman Success in Seven Science and Two Business Administration Courses at the University of Alberta." Unpublished Master's Thesis, University of Alberta, Edmonton, April, 1959.